Development and Validation of the Tele-Pulmonary Rehabilitation Acceptance Scale

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Development and Validation of the Tele-Pulmonary Rehabilitation Acceptance Scale

Abstract

Introduction: Using telehealth in pulmonary rehabilitation (telerehabilitation) is a new field of health care practice. To successfully implement a telerehabilitation program, measures of acceptance of this new type of program need to be assessed among potential users. The purpose of this study was to develop a scale to measure acceptance of using telerehabilitation by health care practitioners and patients. Methods: Three objectives were met a) constructing a modified scale of the technology acceptance model, b) judging the items for content validity, and c) judging the scale for face validity. Nine experts agreed to participate and evaluate item relevance to theoretical definitions of domains. To establish face validity, seven health care practitioners and five patients were interviewed to provide feedback about the scale's clarity and ease of reading. Results: The final items were divided into two scales reflecting health care practitioner and patient responses. Each scale included three subscales: perceived usefulness, perceived ease of use, and behavioral intention. Conclusions: The two scales, each with three subscales, exhibited evidence of content validity and face validity. The 17-item telerehabilitation acceptance scale for health care practitioners and the 13-item telerehabilitation acceptance scale among patients warrant further psychometric testing as valuable measures for pulmonary rehabilitation programs.

Key words: Telehealth, telerehabilitation, acceptance, pulmonary rehabilitation, patients with chronic respiratory diseases, health care practitioners, content validity, and face validity.

Development and Validation of the Tele-Pulmonary Rehabilitation Acceptance Scale

Introduction

Chronic pulmonary diseases are among the most challenging diseases for health care providers to manage because of the wide-ranging impacts on patients' medical, social, and economic status [1]. The treatment plan for patients with chronic pulmonary diseases should improve their wellbeing and functional status. Pulmonary rehabilitation (PR) can be used as a facilitator for coping with the long-term effects of chronic respiratory disease even after maximizing medical management [2].

The American Thoracic Society (ATS) and the European Respiratory Society (ERS) defines pulmonary rehabilitation as:

> A comprehensive intervention based on a thorough patient assessment followed
> by patient-tailored therapies stretching across, education exercise training, and
> behavior change, designed to improve the physical and psychological condition of
> people suffering from chronic respiratory disease and to promote the long-term
> adherence to health-enhancing behaviors. [3]

Providing PR services in the current healthcare system is challenging due to the increasing number of patients with chronic respiratory diseases, and apparent shortage in health care providers and PR programs [4]. As found by Alsubaiei et al., lack of hospital capacity, trained health care providers, and funds were barriers for setting up PR programs in Saudi Arabia [5]. Further complicating this challenge is underutilization of PR programs where they are available [6]. Keating et al. (2011) found that the percentage of non-attendance in PR ranged from 8.3% to 49.6%, and non-completers ranged from 9.7% to 31.8%. Low utilization rates were associated with poor access to a rehabilitation program, lack of transportation, and inconvenient timing of the programs for patients. Telehealth and telerehabilitation are emerging modes of providing

health care services with potential to address these issues and improve patients' PR program participation and adherence.

Telehealth is the use of telecommunication technology and computers to provide and receive clinical health care services. Application of telehealth in pulmonary rehabilitation (telerehabilitation) is a new and promising field of health care practice. As a new field of practice, it is important to understand the potential barriers to implementation of telerehabilitation in PR such as uncertainty and misperceptions held by future users of the technology [8]. Specifically, determinants of acceptance to use telerehabilitation need to be identified among potential users such as healthcare providers and patients before implementation. The influence of these factors has not been previously studied or reported, even though it is vitally important to support development of telerehabilitation systems that consider patients' and health providers' needs [9].

Increased interest in telehealth activities has led to more focus on understanding users' intentions to use telehealth. Users' acceptance of telehealth is suggested as one of the determinants of future use and adherence to telehealth services [10]. Specifically, health professionals' acceptance of telehealth has been identified as a key factor that affects success and sustainability of telehealth programs, [4] and lack of staff acceptance of telehealth has been reported as a potential barrier to telehealth implementation [8]. Non-acceptance among potential telehealth users may lead to low levels of utilization of the proposed telehealth program [11]. These data suggest that understanding the potential users' acceptance of telehealth will lead to successful, high quality, and safe implementation of telehealth programs [12]. From the patients prospective, patients with low levels of telehealth acceptance might use the telehealth services less, which might reduce the potential benefits of the program [10]. Understanding potential users'

determinants of telerehabilitation acceptance could increase telerehabilitation programs usage, ease the implementation of telerehabilitation, and decrease the gap between expectations of the telerehabilitation programs and the reality which may include difficulties [4]. The purpose of this study was to develop a scale with evidence of validity to measure acceptance of using telerehabilitation from the perspectives of health care practitioners and patients.

Methods

Development and validation of the Tele-Pulmonary Rehabilitation Acceptance Scale (TPRAS) study was designed to meet three objectives: constructing a modified scale of the technology acceptance model, judging the items for content validity, and judging the scale for face validity.

Model Construction

The technology acceptance model (TAM) is a theoretical model developed by Fred D. Davies (1985) to describe the key factors that contribute to information technology acceptance, which can help to discover the problems in any new system before implementation. According to the TAM, perceived usefulness and perceived ease of use are the major determinants of the positive intention to use technology (Figure 1) [13]. The TAM is considered as one of the most used and applied models among the theoretical models that explained users' acceptance of technology [14]. The TAM is very powerful in identifying factors that influence acceptance of computer technology. At the same time, using the TAM is considered easy and simple [15].

Constructs of the TAM. People tend to use new technology systems when they believe that the new technology will help them to perform better. This can be referred as "perceived usefulness". Perceived usefulness (PU) is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" [13]. People also consider

whether the new system is hard to use or not which speaks to the second influence of acceptance " perceived ease of use" (PEOU). PEOU is defined as "the degree to which a person believes that using a particular system would be free of effort" [13]. Although multiple studies have confirmed the TAM's validity and reliability [16, 17], additional studies are needed to validate the TAM's utilization, especially in the context of telehealth and telerehabilitation.

Content Validity

Fifteen experts were invited to participate in the content validity assessment. Experts were required to have one of the following: doctorate or master's degree in health care related fields, papers published in the filed of pulmonary rehabilitation; telehealth; information technology; or scale development, or have experience working in pulmonary rehabilitation or telehealth. The evaluation form used in this assessment consisted of relevance ratings for each item with a column for experts to provide comments (Appendix A). The content experts evaluated each item for wording, layout, clarity, redundancy, and relevance to the scale's domains based on the domains' theoretical definitions. Two rounds of content validity assessments were conducted. The first round was to categorize the items and rate their relevance. In Round 1, the reviewers categorized each item as falling under the PU or PEOU domain. Then, the experts evaluated each item's relevance to the assigned domain using a 4-point Likert scale: 1 = not relevant, 2 = relevant, needs major revision, 3 = moderately relevant, needs minor revision, and 4 = very relevant, no modification. The reviewers also evaluated the relevance of the behavioral intention (BI) items using the same 4-point Likert scale. In Round 1 of the evaluation, the item content validity index (I-CVI) was calculated for each item. The item-CVI is the number of reviewers giving a rating of either 3 or 4 for an item relevance (moderately relevant or very relevant) divided by the total number of reviewers [18]. Round 2 of the evaluation

was to finalize the inclusion of the items. In this evaluation, each item was followed by a dichotomous scale with two options for inclusion: YES or NO. The scale-CVI was calculated for each subscale. Scale-CVI is the proportion of high-rated items that received 3 or 4 in the 4-point relevance scale by the raters [18].

Face Validity

In this study, face validity was the extent to which the scale reflects factors that affect acceptance of using telerehabilitation in the future. Seven health care practitioners working in PR programs participated in this assessment, including one physician, two nurses, one physiotherapist, and three respiratory therapists. The physiotherapist was working in Saudi Arabia and the rest of the participants were working at IU Health Hospitals, Indiana. Five patients attending traditional outpatient PR programs agreed to participate in evaluating the survey questions. Four of the participants in this face validity assessment were attending the outpatient PR center at IU Health Hospital, Indianapolis, Indiana. One of the participants was attending the outpatient PR center at St. Vincent rehabilitation center, Indianapolis, Indiana. During in-person interviews, phone calls, or emails, each participant was provided with the final version of the TPRAS in both electronic and paper-based formats. To get participants' feedback, three open-ended questions were asked after completing the survey: How do you rate the scale's instruction and items in terms of clarity and ease of read?, How do rate the clarity of the demographic questions?, and Do you suggest additional questions for the demographic questions?

This study was approved by the Indiana University Institutional Review Boards (IRBs). All the participants were informed about the purpose and methods of the study. They were informed that participation in this study was voluntary and that their responses would be

confidential.

Results

Content Validity Findings

An evaluation form was created for the newly developed items for both healthcare practitioners and patients. Of the 15 content experts, nine agreed to participate and completed the evaluation form. Data from Round 1 were categorized based on the reviewers' evaluation (Table 1). The item content validity index (I-CVI) was calculated for each item (Tables 2 and 3). To construct the perceived usefulness (PU) and the perceived ease of use (PEOU) scales, items with CVIs of ≥ 0.83 were directly included in the scale to be evaluated in Round 2. Of the 30 items in the PU and PEOU item pool, 14 items were rated with CVIs of ≥ 0.83. Only three items from the PU and PEOU items pool with CVIs of 0.78 were included in the final items list (items 5,11, and 20). From the behavioral intention (BI) item pool, three items met the criteria of CVIs ≥ 0.83. One item was rated with CVI of 0.78 (BI 1).

Scale-CVIs for the first evaluation round for each of the subscales (PU and PEOU) and (BI) were 0.84 and 0.80 respectively. All items with CVIs of ≥ 0.83 were used to create two lists of items (PU) or (PEOU), based on reviews' categorization. The experts suggested writing two scales; one intended to measure acceptance of using telerehabilitation among health care practitioners and one intended to measure acceptance of using telerehabilitation among patients with chronic respiratory diseases. Items retrieved from Round 1 were listed in two scales to be reevaluated in Round 2.

In Round 2 evaluation, only seven evaluation forms were completed and returned by the experts on the review panel. Items with CVIs ≥ 0.78 were included in the final version of the scales. Only one item with a CVI of 0.71 was included in the patient version of the scale (item

10), and only one item with a CVI of 0.71 (item 7) was included in the health care practitioners version of the scale. The final items were divided into two scales. One scale was designed to measure telerehabilitation acceptance among patients with chronic respiratory diseases, and the other was designed to measure telerehabilitation acceptance among health care practitioners working in PR programs (Tables 4 and 5).

Face Validity Assessments

Face validity assessment of the TPRAS was conducted by a group of health care practitioners and a group of patients. Seven health care practitioners working in PR programs participated in the face validity assessment. The patients' version of the TPRAS was reviewed by five patients attending traditional PR programs. All items were deemed appropriate and clear based on the questions presented to the health care practitioners and the patients during face validity evaluations.

Discussion

In tandem with the growth of telehealth, there is an increasing interest in the rehabilitation field in using telehealth and in switching to what is called telerehabilitation [19]. Results of this scale development study provided evidence of content and face validity of the TPRAS. This study developed two versions of the TPRAS. One version with 13 items to measure telerehabilitation acceptance among patients with chronic respiratory diseases and one version with 17 items to measure telerehabilitation acceptance among health care practitioners working in PR programs. The scale developed herein can be utilized to collect data from health care practitioners working in PR programs and patients attending PR programs. Understanding potential users' intentions to use telerehabilitation is a key factor in ensuring successful and prolonged implementation [12].

Development and Validation of the Tele-Pulmonary Rehabilitation Acceptance Scale

This is the first study to develop and validate a psychometric instrument to measure telerehabilitation acceptance among health care practitioners working in PR programs and patients attending PR programs. One relevant study utilized the unified theory of acceptance and use of technology to examine factors that affect acceptance of new technologies for rehabilitation by therapists but did not report the process of content validity [20]. The scope of telerehabilitation in this same study was different than the telerehabilitation practice of interest in our acceptance measurement, which includes the use of telecommunication technologies to provide and receive rehabilitation services for patients at home. Another recent study explored the technology engagement level of people attending PR and its effect on their intention to use telerehabilitation [21]. Even though the main goal of this second study was to only assess the level of technology engagement and its effect on the intention to use telerehabilitation, it is a key study that examined how the demographics of patients might influence their intentions to use telerehabilitation when it is available in their rehabilitation facility.

The goal of our study was to develop and validate a tool to measure acceptance of using telerehabilitation among the key potential users including health care practitioners and patients. Now that evidence of content validity and face validity of the TPRAS has been obtained, further studies are warranted to measure telerehabilitation acceptance of health care practitioners and patients. Further studies are also needed to provide evidence of internal consistency reliability and construct validity of the TPRAS. The TPRAS shows great potential as a useful measure to determine acceptance of using telerehabilitation among healthcare practitioners and patients with chronic respiratory conditions.

Limitations

There were several limitations in our study despite the novel findings from the scale development process. First, the findings from our study may be challenged because two of the experts from the Round 1 evaluation did not return the Round 2 evaluation forms. This may have affected the degree of agreement from Round 1 to Round 2. The review panel in Round 2 still included experts with similar expertise comparable to the panel in the Round 1, which minimized the effect of loosing feedback from two experts. Second, the initial plan was to meet each expert to explain the goal and the content evaluation steps, meeting all the reviewers was not achievable because of geographical and time barriers.

Conclusion

This study provides evidence of content and face validity of the Tele-Pulmonary Rehabilitation Acceptance Scale (TPRAS). The current study developed two versions. One version with 13 items to measure telerehabilitation acceptance among patients with chronic respiratory diseases and one version with 17 items to measure telerehabilitation acceptance among health care practitioners working in PR programs. The TPRAS has demonstrated evidence of content validity as evaluated by a panel of experts in fields of pulmonary rehabilitation, telehealth, information technology, and scale development.

The TPRAS is significant as it provides one standardized data collection tool to measure telerehabilitation acceptance among potential users. Since using telerehabilitation is still a new field of practice, measuring its acceptance is an essential step before starting the clinical applications. Measuring acceptance of patients and health care practitioners will help to assure successful implementation and positive outcomes of future telerehabilitation programs.

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Development and Validation of the Tele-Pulmonary Rehabilitation Acceptance Scale

Quick Look

Current Knowledge

Using telerehabilitation is a new method of providing rehabilitation services for patients at home via the Internet. Understanding acceptance of using telerehabilitation is a key element in ensuring successful implementation. Currently, there is no scale with evidence of validity and reliability that could be used to measure acceptance of using telerehabilitation among potential users.

What This Paper Contributes To Our Knowledge

This study provided evidence of content and face validity of two newly developed scales that could be used to measure telerehabilitation acceptance among health care practitioners and patients. The content and face validity of the scales were established by a group of experts in fields related to telerehabilitation and a group of potential users of telerehabilitation.
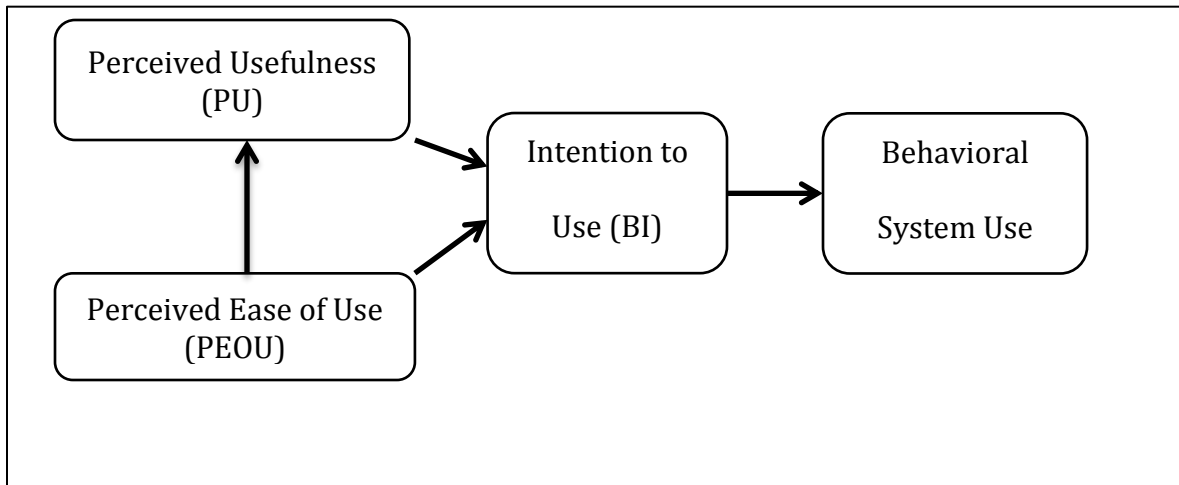
Figure 1.

Table 1

Items Categorization Based on Reviewers ' Evaluation from Round 1.

#	Items Pool	Raters' CVI	Assigned Category
1	Telerehabilitation will allow me to do my tasks more quickly	.55	PEOU
2	Telerehabilitation will allow me to accomplish more than face-to-face rehabilitation	.67	PU
3	Telerehabilitation will give me greater control over my disease symptoms.	.89	PU
4	Telerehabilitation will save me time	.67	PU
5	Telerehabilitation will be flexible to use	.89	PEOU
6	Telerehabilitation will improve access to the rehabilitation programs	.89	PU
7	Learning to operate the telerehabilitation equipment will be easy for me	1.00	PEOU
8	It will be easy to get the telerehabilitation equipment to do what I want it to do	1.00	PEOU
9	My interaction with the telerehabilitation equipment will be clear	.78	PEOU
10	Telerehabilitation will be easy to use	.89	PEOU
11	Providing/ Receiving pulmonary rehabilitation services using telerehabilitation will be more convenient	.56	PU
12	Using telerehabilitation technology will be understandable	.89	PEOU
13	Telerehabilitation will meet my needs	.78	PU
14	Using Telerehabilitation will improve my performance	.78	PU
15	Telerehabilitation will increase the quality of the pulmonary rehabilitation services	.78	PU
16	Telerehabilitation will improve my attendance in the rehabilitation program	.78	PU
17	Telerehabilitation will cancel transportation difficulties in getting to the rehabilitation center	.67	PU
18	It will be easy for me to become skillful in using telerehabilitation equipment	.89	PEOU
19	Telerehabilitation will decrease the cost of the rehabilitation program	.67	PU
20	Using telerehabilitation will be simple	1.00	PEOU
21	Telerehabilitation will facilitate monitoring of the disease	1.00	PU
22	Telerehabilitation will give me the feeling of being safe	.78	PU
23	Telerehabilitation will improve the rehabilitation plan	1.00	PU
24	Telerehabilitation will give me the feeling of being continuously monitored	.89	PU
25	Telerehabilitation could help me provide/ receive care more quickly	.89	PU
26	Education sessions will be easier when using telerehabilitation.	.78	PEOU
27	Telerehabilitation will be useful in the rehabilitation program	1.00	PU
28	Telerehabilitation will save me time of travelling to the health care center	.56	PU
29	Telerehabilitation will improve the relationship between the health care provider and the patient	1.00	PU
30	Telerehabilitation does not require a lot of my mental effort	.89	PEOU

PU = Categorized as Perceived Usefulness.

PEOU = Categorized as Perceived Ease of Use.

Table 2

Perceived Usefulness and Perceived Ease of Use Items' CVIs and S-CVI From Round 1.

#	Items Pool	Item CVI
1	Telerehabilitation will allow me to do my tasks more quickly	.78
2	Telerehabilitation will allow me to accomplish more than face-to-face rehabilitation	.78
3	Telerehabilitation will give me greater control over my disease symptoms	.78
4	Telerehabilitation will save me time	**.89**
5	Telerehabilitation will be flexible to use	.78
6	Telerehabilitation will improve access to the rehabilitation programs	**.89**
7	Learning to operate the telerehabilitation equipment will be easy for me	**1.00**
8	It will be easy to get the telerehabilitation equipment to do what I want it to do	.67
9	My interaction with the telerehabilitation equipment will be clear	.67
10	Telerehabilitation will be easy to use	**1.00**
11	Providing/ Receiving pulmonary rehabilitation services using telerehabilitation will be more convenient	.78
12	Using telerehabilitation technology will be understandable	.78
13	Telerehabilitation will meet my needs	.78
14	Using Telerehabilitation will improve my performance	.78
15	Telerehabilitation will increase the quality of the pulmonary rehabilitation services	.78
16	Telerehabilitation will improve my attendance in the rehabilitation program	**1.00**
17	Telerehabilitation will cancel transportation difficulties in getting to the rehabilitation center	**1.00**
18	It will be easy for me to become skillful in using telerehabilitation equipment	**.89**
19	Telerehabilitation will decrease the cost of the rehabilitation program.	.67
20	Using telerehabilitation will be simple	.78
21	Telerehabilitation will facilitate monitoring of the disease	**.89**
22	Telerehabilitation will give me the feeling of being safe	.56
23	Telerehabilitation will improve the rehabilitation plan	.78
24	Telerehabilitation will give me the feeling of being continuously monitored	**1.00**
25	Telerehabilitation could help me provide/ receive care more quickly	**1.00**
26	Education sessions will be easier when using telerehabilitation	**.89**
27	Telerehabilitation will be useful in the rehabilitation program	**.89**
28	Telerehabilitation will save me time of travelling to the health care center	**1.00**
29	Telerehabilitation will improve the relationship between the health care provider and the patient	**.89**
30	Telerehabilitation does not require a lot of my mental effort	.67

S-CVI= the proportion of items that achieved a rating of 3 or 4 by all the reviewers.

S-CVI Ave= average of the I-CVIs. S-CVI= .84.

Underlined item: items with ICV ≤ .78 and included in the next evaluation after revision.

Table 3

Behavioral Intention Items' CVIs and S-CVI From Round 1.

#	Items Pool	Item CVI
BI 1	<u>I am positive toward using the telerehabilitation</u>	.78
BI 2	I will use the telerehabilitation when it becomes available	**.89**
BI 3	I am willing to use telerehabilitation to provide/receive pulmonary rehabilitation services	**.89**
BI 4	I will use the telerehabilitation to provide/receive pulmonary rehabilitation services as often as needed	**1.00**
BI 5	I will use the telerehabilitation to provide/receive pulmonary rehabilitation services rather than the traditional face-to-face sessions	.67
BI 6	I will usually use telerehabilitation	.56

BI1- BI6= Behavioral Intention items.

S-CVI= the proportion of items that achieved a rating of 3 or 4 by all the reviewers.

S-CVI Ave= average of the I-CVIs. S-CVI= .80.

<u>Underlined item</u>: items with ICV ≤ .78 and included in the next evaluation after revision.

Table 4

Patients' Version of the Telerehabilitation Acceptance Scale

Perceived Usefulness (PU) of Telerehabilitation		*I-CVI*
6	Telerehabilitation will improve my access to rehabilitation programs	1.00
16	Telerehabilitation will improve my attendance in the rehabilitation program	.86
17	Telerehabilitation will eliminate transportation difficulties in getting to the rehabilitation center	1.00
25	Telerehabilitation could help me to receive care more quickly at home	.86
27	Telerehabilitation will be useful in the rehabilitation program	1.00
29	Telerehabilitation will improve my communication with the health care provider	1.00
32	Telerehabilitation will improve my commitment to the rehabilitation program	NA
	Patients' PU Scale-CVI	.82
Perceived Ease of Use (PEOU) of Telerehabilitation		
7	Learning to operate the telerehabilitation equipment will be easy for me	.86
10	Telerehabilitation will be easy to use	.71
11	Receiving pulmonary rehabilitation services at home using telerehabilitation will be more convenient	.86
26	Education sessions will be easier when using telerehabilitation	1.00
	Patients' PEOU Scale-CVI	.89
Behavioral Intention (BI) to Use Telerehabilitation		
BI 3	I will plan to use telerehabilitation to receive pulmonary rehabilitation services	1.00
BI 4	I will use telerehabilitation to receive pulmonary rehabilitation services as often as recommended by my provider	.86
	Patients' BI Scale-CVI	.93
	Scale-CVI	.88

Table 5

Health Care Practitioners' Version of the Telerehabilitation Acceptance Scale

Perceived Usefulness (PU) of Telerehabilitation		*I-CVI*
4	Telerehabilitation will save me time	1.00
6	Telerehabilitation will improve patients' access to rehabilitation programs	1.00
16	Telerehabilitation will improve patients' attendance in the rehabilitation program	1.00
21	Telerehabilitation will facilitate monitoring of the patients' disease symptoms	1.00
25	Telerehabilitation could help me to provide care more quickly for patients at home	1.00
27	Telerehabilitation will be useful in the rehabilitation program	1.00
29	Telerehabilitation will improve my communication with the patients	.86
31	Telerehabilitation will facilitate monitoring of the patients' daily activities	.86
32	Telerehabilitation will improve patients' adherence to the rehabilitation program	NA
	Health Care Practitioner' PU Scale-CVI	.86
Perceived Ease of Use (PEOU) of Telerehabilitation		
7	Learning to operate the telerehabilitation equipment will be easy for me	.71
10	Telerehabilitation will be easy to use	1.00
11	Providing pulmonary rehabilitation services using telerehabilitation will be more convenient	.86
26	Education sessions will be easier when using telerehabilitation	1.00
	Health Care Practitioner' PEOU Scale-CVI	.89
Behavioral Intention (BI) to Use Telerehabilitation		
BI 1	I feel positive about using telerehabilitation	.86
BI 2	I will use telerehabilitation when it becomes available in my rehabilitation center	1.00
BI 3	I will use telerehabilitation to provide pulmonary rehabilitation services	1.00
BI 4	I will use telerehabilitation to provide pulmonary rehabilitation services as often as recommended by the care team	.86
	Health Care Practitioner' BI Scale-CVI	.93
	Scale-CVI	**.83**